LAKE ERIE

LAKEWIDE MANAGEMENT PLAN

# Lake Erie Lakewide Management Plan (LaMP) Technical Report Series

## Impairment Assessment of Beneficial Uses: Drinking Water Consumption Restrictions or Taste and Odor Problems

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**Lake Erie LaMP Technical Report No. 11**

# Technical Report 11

# Drinking Water Consumption Restrictions or Taste and Odor Problem Restrictions

Prepared for the Lake Erie LaMP
Preliminary Beneficial Use Impairment Assessment
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**NOTE TO THE READER:**

This technical report was prepared as one component of Stage 1, or "Problem Definition" for the Lake Erie LaMP. This report provides detailed technical and background information that provides the basis for the impairment conclusions recorded in the Lake Erie LaMP *Status Report*.

This document has been extensively reviewed by the government agencies that are partnering to produce the LaMP, outside experts, and the Lake Erie LaMP Public Forum, a group of approximately of 80 citizen volunteers. This review was designed to answer two questions:

- Is the document technically sound and defensible?
- Do the reviewers agree with the document conclusions and format?

In its present form, this report has been revised to address the comments received during that review process, and there is majority agreement with the impairment conclusions presented.

## 11.1 Listing Criteria

According to the International Joint Commission (IJC), a drinking water consumption restriction impairment occurs when "treated water supplies are impacted to the extent that:

1) densities of disease-causing organisms or concentrations of hazardous/toxic chemicals or radioactive substances exceed human health standards, objectives or guidelines;

2) taste and odor problems are present; or

3) treatment needed to make raw water suitable for drinking is beyond the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e. coagulation, settling, disinfection) (IJC, 1989).

## 11.2 Scope of Assessment

The geographic scope of the Lake Erie Lakewide Management Plan (LaMP) beneficial use impairment assessment (BUIA) includes open lake waters, nearshore areas, river mouths and embayments, and the lake effect zone of Lake Erie tributaries. The lake effect zone is defined as that zone where the waters of the lake and the tributary river are mixed.

The Beneficial Use Impairment Assessment Subcommittee (BUIASC) further clarified the scope of problem definition, as follows:

a) Assessment covers **treate**d drinking water from **public** systems, (i.e., municipal water treatment facilities) with **Lake Erie** as a source.

b) Two criteria must both be met for a taste and odor problem to be considered an impairment.

-The problem must be **persistent** (more than a periodic problem for several days at a time).

-If persistent, the problem is not correctable with **standard treatment.** In other words, if a taste and odor problem persists due to lack of standard treatment implementation, it is not an impairment. The real problem is not Lake Erie, but lack of proper treatment.

c) Impairments due to costs for zebra mussel monitoring and control were included in the Added Costs to Agriculture and Industry assessment to avoid confusion. The key issue in the Drinking Water assessment is human health, whereas the key issue in the Added Costs assessment is cost. Zebra mussels are not causing human

health problems.

The BUIASC evaluated drinking water standards, objectives, or guidelines established by both the IJC and individual Lake Erie jurisdictions to determine if there were any documented exceedances of human health standards. Taste and odor problems, where reported, were evaluated with respect to IJC criteria and individual jurisdictional criteria, where they exist.

## 11.3 Background

*Human Health Standards for Treated Drinking Water*

For drinking water, microbiological contamination is the major concern for human health. As recently as the early 1900s, people died of typhoid fever after drinking communal water contaminated by the bacterium *Salmonella typhi*. However, bacterial contamination is generally no longer a problem in municipal water supplies due to chlorination at drinking water treatment plants. (Great Lakes Health Effects Program, Health and Environment: A Handbook for Health Professionals, Draft, 1995.)

Some protozoan parasites, such as *Giardia* and *Cryptosporidium*, may, however, form cysts, which are resistant to chlorination. These cysts may persist for long periods of time in natural waters. *Giardia* can cause an intestinal illness called giardiosis, and *Crytosporidium* can cause a similar illness called crytosporidiosis. Municipal treatment of drinking water includes filtration along with disinfection to reduce the risk of contamination of treated drinking water. *Giardia* and *Cryptosporidium* are beginning to be looked at more closely to determine the extent, if any, of contamination of drinking water supplies.

In most cases, drinking water accounts for very little of our exposure to toxic or persistent chemicals in the environment. However, in recent years, there has been a growing awareness and concern over the presence of a wide range of chemical contaminants in drinking water. Levels are extremely low (in the parts per trillion or parts per quadrillion range), and at such low levels, their mere presence in drinking water does not necessarily mean that there is any risk to health.

Chemical contaminants in drinking water may include naturally occurring chemicals (such as arsenic and asbestos), radioactive materials (such as radon), and synthetic chemicals from industrial effluents and emissions. Trihalomethanes may be formed during the process of water chlorination or other treatment processes. Substances such as lead and copper may come from the materials used in the water distribution system itself.

Drinking water guidelines and objectives have been developed to insure contaminants remain far below the levels at which adverse health effects have been observed. This assessment takes a look at contaminant levels and whether there are exceedances of the

guidelines and objectives.

*Taste and Odor Standards*

Researchers have been studying taste and odor problems in drinking water supplies since the beginning of this century. The results of these studies have identified various organisms (including the phytoplankton genera *Aphanizomenon*, *Anabaena*, *Microcystis*, and *Dinobryon*) which have either been responsible for or contributed to taste and odor problems by producing methyl-iso-borneol (MIB), geosmin, and trichloroanisole . Several treatment methods designed to mitigate taste and odors have also been investigated, including the addition of copper sulfate and various chemical oxidants, as well as the introduction of bacteria capable of metabolizing oil-like organic compounds.

## 11.4 Summary of Drinking Water Standards by Jurisdiction

### 11.4.1 U.S. Federal Standards

Drinking water protection standards in the U.S. are addressed by both the Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA). The SDWA addresses both protection of drinking water at the source and protection of human health through the drinking water treatment process. Among other things, the Clean Water Act establishes "designated uses" of surface waters, including use as drinking water sources.

The 1996 Safe Drinking Water Act Amendments require that source water assessments be performed on all sources of public drinking water supplies. The intent behind the amendments is to build a system of prevention barriers to drinking water contamination. Under these amendments, states are required to develop comprehensive Source Water Assessment Programs (SWAPs) that will:

- Identify the areas that supply public tap water;
- Inventory contaminants and assess water system susceptibility to contamination;
- Inform the public of the results (USEPA, 1997).

These assessments on sources that have intakes in the Great Lakes present a unique challenge. Some of these intakes extend far into a lake and receive no effects from shoreline events, while other receive impacts from near land events. As of February 1998, the Great Lakes States were reviewing a preliminary draft proposed protocol for performing these assessments (USEPA, 1998).

In addition to the 1996 SDWA amendments for drinking water source protection, at a minimum, all States must follow USEPA drinking water treatment regulations designed to protect human health. The three key standards are: a) 3.0 log removal or inactivation of *Giardia*; b) filtration down to 0.5 NTU (nephelometric turbidity units) in 95 percent of

samples taken; and c) disinfection CT (concentration x time) value required is achieved. The CT value is based on a table that takes into account pH, residual chlorine at the sampling point, and water temperature.

Section 305(b) of the Clean Water Act outlines requirements for making drinking water use support determinations. The primary focus of 305(b) drinking water regulations is the "no treatment plant shutdowns" requirement. 305 (b) regulations also address whether any drinking water "advisories" went into effect and how long these were in effect; treatment necessary beyond "reasonable levels"; adverse effects on treatment cost; and the quality of polished water (such as taste and odor problems, color, excessive turbidity, high dissolved solids, pollutants requiring activated charcoal filters, etc.) in determining whether a waterbody is fully supporting, partially supporting, or not supporting drinking water use.

### 11.4.2 Michigan

*Human Health Standards for Treated Drinking Water*

The Michigan Department of Environmental Quality (MDEQ) monitors the quality of its community water supplies according to requirements under Part 7 of the Administrative Rules for Supplying Water to the Public D-227 8/93 Authority: Act 399, P.A. 1976, Michigan Department of Public Health.

*Taste and Odor Standards*

Michigan currently has no state-wide standards in place, which could be used to assess taste and odor problems in drinking water supplies. However, each water treatment plant does have some individual standards in place, some of which are more developed than others. For example, in Saginaw Bay, where taste and odor problems have been experienced in the past, drinking water supply taste and odor standards are fairly well-developed.

### 11.4.3 New York

*Human Health Standards for Treated Drinking Water*

New York's water quality standards for drinking water are contained in sections 702.2 (standards and guidance values for protection of human health and sources of potable water supplies) and 703.2 (narrative water quality standards) of the New York State Department of Environmental Conservation's Water Quality Regulations, Surface Water and Groundwater Classifications and Standards, New York State, Codes, Rules and Regulations, Title 6, Chapter X.

*Taste and Odor Standards*

Section 702.1 of New York's Water Quality Regulations provides that the control of taste-, color- and odor-producing, toxic or other deleterious substances is implemented through the use of standards and guidance values. Section 702.12 also states that the procedures used to derive standards and guidance values should be based on "aesthetic considerations, including but not limited to taste, odor and discoloration."

### 11.4.4 Ohio

*Human Health Standards for Treated Drinking Water*

The State of Ohio Environmental Protection Agency, Division of Drinking and Ground Waters, monitors the quality of Ohio s public water systems according to the rules and regulations stipulated in the Ohio Administrative Code, Chapter 3745-81 Primary Drinking Water Rules effective 12/1/93.

*Taste and Odor Standards*

With the exception of fluoride, secondary drinking water standards are in place to address aesthetics problems with water, such as taste, odor and color. Rule 3745-82-02 of the Ohio Revised Code (ORC) has established secondary maximum contaminant levels for public water systems as follows:

| **Contaminant** | **Level** |
|---|---|
| Aluminum* | 0.05 to 0.2 mg/L |
| Chloride | 250 mg/L |
| Color | 15 color units |
| Corrosivity | non-corrosive |
| Fluoride | 2.0 mg/L |
| Foaming Agents | 0.5 mg/L |
| Iron | 0.3 mg/L |
| Manganese | 0.05 mg/L |
| Odor | 3 threshold odor number |
| pH | 7.0-1.5 |
| Silver | 0.1 mg/L |
| Sulfate | 250 mg/L |
| Total dissolved solids (TDS) | 500 mg/L |
| Zinc | 5 mg/L |

* The secondary maximum contaminant level for aluminum is a range, with the precise level applicable to each public water system to be determined by the Director of Ohio EPA.

In particular, iron and manganese standards are designed to address taste problems.

### 11.4.5 Ontario

*Human Health Standards for Treated Drinking Water*

Water production and quality in Ontario is governed by the Ontario Water Resources Act. Ontario Drinking Water Objectives (ODWOs) are the guidelines by which water quality is assessed (Ontario MOEE, 1994). They include health, aesthetics and operational guidelines. Certificates of Approval outline the monitoring requirements by treatment facility operators. Minimum sampling requirements have been issued to all treatment facilities for 1996. The sewage and water inspection program (SWIP) audits all treatment facilities once every two to four years.

On a Province-wide basis, water quality is judged by comparing data collected at water treatment plants under the Ontario Drinking Water Surveillance Program (ODWSP) to the Ontario Drinking Water Objectives (ODWO) (Ontario MOEE, 1994). The ODWSP looks at raw, treated and distributed water. Treated water will be the focus of this discussion, as mentioned above.

*Taste and Odor Standards*

Ontario has aesthetic objectives, which apply to certain substances or characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water. For certain parameters, both aesthetic objectives and health-related guidelines (i.e., maximum acceptable concentrations) have been derived. Where only aesthetic objectives are specified, these values are below those considered to constitute a health hazard. However, if a concentration in drinking water is well above an aesthetic objective, there is a possibility of a health hazard. (Guidelines for Canadian Drinking Water Quality (Fifth Edition, Health and Welfare Canada))

### 11.4.6 Pennsylvania

*Human Health Standards for Treated Drinking Water*

The Pennsylvania Department of Environmental Protection (PADEP) monitors the quality of its Community Water Systems according to the National Primary Drinking Water Regulations, 40 CFR Part 141.

*Taste and Odor Standards*

Fourteen taste and odor parameters are included in Pennsylvania's water quality criteria (Pennsylvania Code, Title 25, Chapter 16, Section 16.51) as follows:

copper
phenolics (total phenols)
2,4-dichlorophenol
p-chloro-m-cresol
phenol
anenaphthene
napthalene
2-chlorophenol
2,4-dimethylphenol
pentachlorophenol
chlorobenzene
hexachlorocyclopentadiene
nitrobenzene

## 11.5 Status

### 11.5.1 Michigan

*Human Health Standards for Treated Drinking Water*

Based on Michigan's Administrative Rules for Supplying Water to the Public, no restrictions on drinking water consumption due to violations of standards designed to protect human health have been identified for water supplies with Lake Erie or lake effect intakes in recent years.

*Taste and Odor Standards*

Taste and odor problems were documented in the Detroit River in July and August, 1990, but these problems were determined to be associated with water plants with a Detroit River source rather than a Lake Erie source. There is no evidence that these problems are affecting Lake Erie waters. Therefore, this situation is outside the scope of the BUIA for Lake Erie as defined in section 11.2.

### 11.5.2 New York

*Human Health Standards for Treated Drinking Water*

Based on data provided by the State of New York, no exceedances of drinking water standards have been reported.

*Taste and Odor Standards*

The Erie County Water Authority operates a distribution system that includes 1,661 miles of pipeline, 118,365 service connections, a storage capacity of 48 million gallons, 25

storage tanks, and 18 pumping stations that serves a population of nearly 500,000 customers. Two conventional water treatment facilities provide the system with a total average daily production of 70 to 80 MGD during the summer months (June through September). The Sturgeon Point water treatment plant on the eastern shore of Lake Erie pumps approximately 55 MGD, or the majority of the production demand for this system.

From 1989 to 1996, increased complaints about drinking water taste and odor problems were registered with the ECWA in New York (1993 Taste and Odor/Flavor Profile Panel). In 1991, when the ECWA experienced a dramatic increase in taste and odor complaints from June through September, an analysis of the raw and delivered water identified the major chemical contributors to be MIB and geosmin.

In 1992, the Customer Contact System was instituted in order to document the public's perception regarding the recurrence and impact of taste and odor compounds on drinking water quality. Since that time, chemical and sensory methodologies have been used to monitor the presence of these compounds in the water.

In response to a marked increase in customer complaints in 1993, and elevated levels of the taste and odor compounds MIB and geosmin in eastern Lake Erie, the ECWA began to investigate the impact of these two compounds on water quality, assess various means of effective removal, and identify potential sources.

MIB and geosmin are present in high concentrations in source waters during the time when complaints were most common. Certain species of phytoplankton produce MIB and geosmin as metabolic byproducts and have been implicated in episodes characterized by certain tastes and odors. Lake Erie is the source water for Sturgeon Point, one of two treatment facilities evaluated (Van de Water, which has the Niagara River as its source water, will not be discussed here).

The Sturgeon Point water treatment plant's efficiency was determined by calculating the average percent removal of MIB and geosmin from Lake Erie. From July 27, 1993, to September 29, 1993, concentrations of geosmin in raw water increased dramatically to 13.6 ppt, or seven times the human detection level of 2.0 ppt. Delivered water concentration levels of geosmin during this same time period, however, remained within the range of 2.0 - 3.0 ppt. Thus, the average removal of geosmin at Sturgeon Point was 55 percent.

MIB concentration levels began moving upwards for both raw and delivered water on June 29, 1993. These levels peaked at 178 ppt and 43.2 ppt, respectively, on July 21, 1993. These levels were 89 (raw) and 22 times (delivered) the human detection level of 4 ppt. Following that date, MIB concentrations at Sturgeon Point steadily decreased, leveling off on October 4, 1993. During this time, the average removal of MIB was 61 percent.

Based on the above, removal through treatment was not effective at all times, and both taste and odor compounds were detected during the entire season. Geosmin remained below the human threshold for delivered water, but MIB did not. Flavor Profile Panel results showing MIB as the predominant compound detected in delivered water corroborated analytical results. Geosmin was detected, but was not reported to be as frequent or intense. Both MIB and geosmin, however, were detected in the raw water sources frequently.

Results from 1993 seem to indicate that treatments used in reducing MIB and geosmin (i.e., increasing activated carbon dosages at the anticipated onset of a naturally occurring increase) would be beneficial in regulating taste and odor problems before entering the distribution system. By utilizing the Flavor Profile Panel in conjunction with analytical results, the human senses, which are more sensitive than current analytical instruments, provide some measure by which to modify the treatment process.

Powdered Activated Carbon (PAC) has been the treatment of choice at ECWA (Wittmeyer et. al., in press). The use of PAC is in addition to mixed media filter beds for the removal of MIB and geosmin. The primary advantage of using PAC is that it can be applied on an as-needed basis and is not as expensive as other approaches, such as major system redesign. These benefits have made PAC the most widely used method of taste and odor removal in the United States.

Potassium permanganate ($KMnO_4$), also reportedly effective in the removal of taste and odor compounds, is injected through chemical feed lines at the ECWA intakes. Recent studies at other facilities have shown that treatment measures in addition to potassium permanganate must be used to control taste and odor compounds. Other means of removal, such as coagulation, sedimentation, filtration, and chemical oxidation, result in insufficient removals of many undesirable compounds, thereby requiring the use of PAC absorption processes in order to effectively control taste and odor. As a result of the methods undertaken by ECWA, the taste and odor problems identified above have been remediated.

Increased complaints of taste and odor problems also corresponded with the first occurrence of heavy zebra mussel infestations. Zebra mussels are thought by some scientists to indirectly affect taste and odors by causing changes in the phytoplankton community. Tests undertaken in 1995 at ECWA's laboratory also explored the hypothesis that zebra mussels directly contribute to the occurrence of taste and odor problems through faeces and pseudofaeces production (Lange and Wittmeyer, in press). Faeces and pseudofaeces production concentrates phytoplankton and hastens their degradation, which, in turn, would increase the production of MIB and geosmin.
From May through October, live zebra mussels were collected every three weeks from the USACOE Black Rock Lock, located midway between the ECWA's two water treatment facilities (Sturgeon Point and Van de Water). Tests were conducted on: 1) raw Black Rock Lock river water; 2) concentrated sediment, detritus, faeces, and pseudofaeces

washed from the interstices of the zebra mussel colony; and 3) concentrated faeces and pseudofaeces from the washed zebra mussel after they were held in spring water for three days.

The results of these tests showed that both MIB and geosmin were detected in the concentrated wash sample (raw sample) and the same from the mussels held for three days (aquaria sample). The concentration of MIB and geosmin (adjusted to concentration per 50 ml of concentrate) was higher than in the water sample each time. While the geosmin concentration was higher in the aquaria samples than in the raw sample on a consistent basis, MIB concentrations did not display a constant trend. Phytoplankton analyses were performed on both the raw water sample and faeces/pseudofaeces samples and included: diatom frustules; intact blue-green algae; and many filamentous bacteria that are known to contribute to occurrences of taste and odor problems.

### 11.5.3 Ohio

*Human Health Standards for Treated Drinking Water*

Based on Ohio's primary drinking water standards for the protection of human health (Ohio EPA, 1993), no restrictions on drinking water consumption have been identified for all Ohio water treatment plants falling within the Lake Erie basin. Following is the list of Ohio Water Treatment Plants using Lake Erie drinking water as a source for human consumption, as provided by the Ohio EPA Division of Drinking and Ground Waters:
City of Avon Lake*
Camp Patmos, Kelley's Island
City of Cleveland (Baldwin)*
City of Cleveland (Crown)*
City of Cleveland (Morgan)*
City of Cleveland (Nottingham)*
City of Conneaut*
Consumer's Ohio Water Company, Mentor*
East Harbor State Park
City of Elyria
Erie Industrial Park
Village of Fairport Harbor
Gem Beach Marina, Inc., Catawba Island
Harbor Island Association, Catawba Island
City of Huron
Village of Kelley's Island
Lake County East*
Lake County West*
Lake Erie Utilities Company, Middle Bass Island
Lakeside Association, Danbury Twp., Ottawa County*
City of Lorain*

Village of Marblehead*
Camp Perry, Ottawa County
Ohio-American, Ashtabula County*
City of Oregon*
City of Painesville*
City of Port Clinton
Village of Put-In-Bay
City of Sandusky
City of Toledo*
City of Vermilion*

Water treatment plants identified with an asterisk (*) have implemented zebra mussel monitoring and/or control mechanisms. The cost of these activities will be addressed as a potential impairment in the Added Costs to Agriculture and Industry impairment assessment.

*Taste and Odor Standards*

There are currently no taste/odor problems reported for finished (treated) public water supplies with Lake Erie/lake effect zone intakes from the same water treatment plants listed in the previous discussion on drinking water.

### 11.5.4 Ontario

*Human Health Standards for Treated Drinking Water*

The Ontario Drinking Water Surveillance Program (ODWSP) provides reliable and current information on drinking water quality. The ODWSP officially began in 1986 and was designed to include all municipal supplies in Ontario. A total of 180 parameters (bacteriology, inorganic and physical chemistry, organic chemistry and radiology) are analyzed in the raw water and in the distribution system.

Restrictions on drinking water consumption were assessed from the information provided in the annual reports from the ODWSP for 11 water treatment plants with source water from Lake Erie. No known health related guidelines were exceeded for these facilities in 1991 and 1992.

Port Rowan Water Treatment Plant (1992 only)
Port Stanley Water Treatment Plant
St. Thomas (Elgin) Water Supply System
Fort Erie (Rosehill) Water Treatment Plant
Union (Essex County) Water Supply System
Chatham Water Treatment Plant
Port Dover Water Supply System

Port Colborne Water Treatment Plant
Harrow-Colchester Water Supply System
Haldimand-Norfolk Water Supply System
Dunnville Water Treatment Plant
Wheatley Harbour Treatment Plant

Fort Erie (Rosehill), Port Dover, Port Colborne, Harrow-Colchester, Haldimand-Norfolk, and Dunnville water treatment systems/plants add chlorine at the mouths of the intake structures for each of these facilities to control zebra mussels when the raw water temperature is above $12^0$C. This may result in added cost to treatment of water for drinking purposes.

*Taste and Odor Standards*

Several water treatment plants have taken measures to address taste and odor problems for their respective facilities. The St. Thomas (Elgin), Fort Erie (Rosehill), and Union (Essex County) water supply/treatment systems add powder activated carbon for taste and odor control. The Chatham Water Treatment Plant chlorinates raw water at the lowlift pumping station before being pumped nine kilometers to the plant itself. Granular activated carbon contactors are used in addition to filters during the summer months at the Port Rowan Water Treatment Plant. Dunnville Water Treatment Plant adds potassium permanganate for taste and odor control, when needed. The Harrow-Colchester Water Supply System also controls taste and odor problems at the plant, but did not specify which mechanisms or compounds are used.

### 11.5.5 Pennsylvania

*Human Health Standards for Treated Drinking Water*

The Pennsylvania Department of Environmental Protection (PADEP) monitors the quality of its Community Water Systems according to the National Primary Drinking Water Regulations, 40 CFR Part 141. The PADEP determines the frequency of the sampling under 25 P.A. code chapter 109. Using Pennsylvania's National Primary Drinking Water Regulations (Pennsylvania, Department of Environmental Protection, 1995), no restrictions on drinking water consumption have been identified by the Erie City Water Authority in recent years.

The City of Erie has two (2) filtration plants that utilize Lake Erie as a source of water. The Chestnut Street plant was built around 1900 and has a design capacity of 30 MGD. The Sommerheim plant was built around 1930 and has a design capacity of 56 MGD. The average water usage for the entire system varies from 40 to 50 MGD throughout the year. The water allocation permit for the Authority allows them to withdraw 62 MGD. That permit expires on March 31, 2020.

The treatment for the two (2) plants is essentially the same. The raw water is pre-chlorinated for zebra mussel control and coagulants are added prior to it's pumping into the sedimentation basins. Following the sedimentation, the water is filtered through rapid sand filters and enters the clearwell after the addition of post chlorination and corrosion control treatment. In the past, the Authority used activated carbon for taste and odor control, but has now stopped. Following the recent invasion of zebra mussels (circa 1988-89), the overall turbidity of the lake has been reduced (pers. comm. Matt Postlewaite, Water Supply and Community Health, PADEP).

*Taste and Odor Standards*

Of the 14 parameters for which Pennsylvania has established water quality standards, "odor" is periodically reported; however, there is no criterion for this parameter.

Five "odor" values exist in the STORET database for the 1985-1990 period of record. No standard exists for this taste and odor parameter, and the measurement units are given as "severity." All odor results were zero.

## 11.6 Impairment Conclusions

*Human Health Standards for Treated Drinking Water*

There is no evidence of restrictions on drinking water consumption for the States of Michigan, New York, Ohio and Pennsylvania, and the Province of Ontario.

Some Ontario, Pennsylvania and Ohio drinking water treatment plants have had to support additional costs due to implementation of zebra mussels control practices. Per IJC listing criteria, the fact that additional treatment is necessary at drinking water plants to control zebra mussels *is* an impairment regardless of whether or not an actual restriction on consumption results. This issue will be dealt with in detail in the "Added Costs to Agriculture and Industry" BUIA.

*Taste and Odor Standards*

Although several water treatment plants have taken measures to address taste and odor concerns, such measures, in and of themselves, do not necessarily indicate that taste and odor problems currently exist. Taste and odor standards, where they exist, are secondary and, because they do not deal with the human health aspects of drinking water, are not enforceable.

Therefore, it is at the discretion of the individual waste water treatment plant administrators to decide whether taste and odor control equipment is installed. In the case of larger facilities where the tax base is large enough to support taste and odor control equipment at a reasonable cost, taste and odor control equipment is often

installed and used constantly as a preventative measure. It does not necessarily mean that there would be a significant taste and odor problem if the taste and odor control equipment were not used; it is simply designed to eliminate all complaints. This seems to be the case with most of those facilities located in the Province of Ontario. In other cases, taste and odor control are used periodically and only when needed.

Specific areas or plants where problems have occurred in the past include: Michigan - Detroit River Area of Concern (1990); and New York - Sturgeon Point (1989-present). Michigan s problems are due to a Detroit River source and are, therefore, outside of the scope of the Lake Erie LaMP. Problems experienced in New York have been remediated by the measures instituted by the ECWA. Ohio, Ontario and Pennsylvania are currently not experiencing any taste or odor problems with their public water supplies which use Lake Erie as a source.

Consequently, there are currently no taste and odor impairments to drinking water in the Lake Erie basin.

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